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Original Article

The Role of Assessment in Mathematics Classrooms: A Review

Dr. Mbuthia Ngunjiri, PhD[1*]

[1] Laikipia University, P. O. Box 1100-20300 Nyahururu, Kenya
* Author for Correspondence ORCID ID: https://orcid.org/0000-0002-4047-0950; Email: mbuthiangunjiri@gmail.com.

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ABSTRACT

This paper tries to understand the role of assessment in bringing changes in students' mathematics performance. Quality assessment is a key factor in improving the learning of mathematics. The relationship between learning and assessment is strong and robust. Students learn more in classes where assessment is an integral part of instruction than in those that are not, and brief frequent assessments that provide immediate feedback about learning progress that are more effective than one summative test. Therefore, mathematics teachers should be aware of the roles of assessment, different methods of assessing learners, and the effective assessment practices.

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INTRODUCTION

In the field of education, the terms of measurement, assessment, and evaluation have been used interchangeably, sometimes causing confusion to many users of the terms. In this paper the meaning of the terms is clearly explained. First, measurement is the process of assigning numerical values to objects and events according to predetermined values (Kithuka, 2012). The information required is in precise quantities, for example in meters, kilogrammes, marks and so on. Measuring is done using measuring instruments, and a test is therefore an instrument

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for measuring students' performance using a percentage scale (Black & William, 2008). Second, evaluation is the process of collecting qualitative and/or quantitative information, analysing the information, and presenting it in a form that facilitates judgment or decision making (Twoli et al., 2007). Third, assessment include all the processes involved in making decisions about students' learning progress (Airasian, 2000). It includes observations of students' written work, their answers to questions in class, and performance in teacher made and standardized tests. It also involves decisions such as re-teaching a topic or assigning grades.

Two basic processes are involved in assessment:(i) measurement (i.e., the process of gathering information about learning), and(ii) evaluation (i.e., the process of making decisions on the basis of measurements). Assessment can either be informal or formal assessment (MoEST, 2012). As a mathematical teacher, you constantly carry out informal assessment. This could be through listening to students' explanations, demonstrations, or deliberate questioning. The characteristics of informal assessment is that it is; (i) ongoing to support students learning, (ii) diagnostic so that it highlights difficulties which a teacher can address. In contrast, formal assessment is; (i) timed, (ii) marked and graded, (iii) emphasizes individual work, and (iv) has internal and external invigilators (MoEST, 2012).

The following literature focuses on functions of classroom mathematics assessment, different methods of assessment and the effective assessment practices

REVIEW OF LITERATURE

Assessment is an important part of mathematics teaching and learning (Kiruhi et al., 2009). One assumption is that assessment serves only a single purpose: to help teachers make grading decisions. But, assessment has much wider functions, at least eight of which are considered briefly at this point. First, assessment can be used to inform mathematics learners of their attainment. Knowledge of results is one of the cornerstones of learning theory. Knowing whether one has attained a goal, or by how much it has been missed or exceeded has been shown to be an important incentive in human performance, especially when results of results quickly follow performance (Ngunjiri, 2022; Pratt, 1980). Second, assessment can be used to diagnose areas of strengths and weaknesses in mathematics (Ngunjiri, 2022; Pratt, 1980). It is not enough for the mathematics teacher to indicate that the student has "passed" or "failed". But both the mathematics teacher and the learner must know areas of strengths and weaknesses if remediation is to be effective.

Third, assessment can be used to guide decisions about the student's future (Ngunjiri, 2022; Pratt, 1980). Adequate academic and career guidance must be based on sound data about the learners' aptitudes, interests, and attainments. At some point, decisions will be made to include some aspirants, and to exclude others from certain courses, programs, and careers especially those that require mathematics as a prerequisite. Such decisions are made by educators, students, or other parties based on valid assessment of achievement data.

Fourth, assessment can be used to inform interested parties of student competence (Ngunjiri, 2022; Pratt, 1980). Parents have a right to know what their children have learnt at school including in mathematics. Employers have to know what capability potential employees have acquired. Tax payers are entitled to know what effects schools they are supporting are imparting on students.

Fifth, assessment maybe used to provide feedback to the instructional system (Nicol & Mcfarlane-Dick, 2006). Any effective teaching of mathematics can achieve its potential only if the results of teaching and learning are monitored and corrective and active actions by mathematics teachers taken where necessary (Ngunjiri, 2022).

Sixth, assessment in mathematics can be used to provide an operational target to the learner (Ngunjiri, 2022; Pratt, 1980). In practice, students set a target for themselves like wanting to get a good grade in mathematics, and the target directs the students' effort in the subject. Seventh, assessment can be used to license candidates for a profession or occupation (Ngunjiri, 2022; Pratt, 1980). For example, engineers, accountants, pilots, surveyors must pass professional examinations to be allowed to practice. These careers among others require a strong background of mathematics.

Eighth, assessment in mathematics can help to promote minimum educational equality (Ngunjiri, 2022; Pratt, 1980). Differences in mathematics

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performance will always exist in different schools and different classrooms. In the absence of achievement data, the extent of such differences will not be recognized for securing equality of minimal educational opportunities such as fair provision of qualified teachers and other needed resources for good performance in various subjects including mathematics.

The purpose and level of assessment will determine the type of assessment a mathematics teacher will carry out. The various methods of assessing learners include: (i) oral assessment, (ii) observation of learners, (iii) written assessment, (iv) projects. Oral assessment is when the teacher asks questions and the students respond (Hattie & Timperley, 2007). As each student responds to the questions, the mathematics teacher may record their score. This will give the total score of each student in relation to their responses (KIE, 2010; Mwangi, 2009). Oral questioning is directly aimed at the processing of information or learning processes, requiring understanding or completing the tasks (Hattie & Timperley, 2007).

Assessment through observation occurs when the mathematics teacher observes students as they carry out given tasks (MoEST, 2012; Mwangi, 2009). The subject teacher can observe the learner in various situations, note his/her attitudes, feelings, interests, changes in behaviour patterns, and relationship between classmates (Mwaka et al., 2014). Written assessment include: (i) assignments, (ii) subjective tests, (iii) objective tests, and (iv) Projects (MoEST, 2012). The assignment is an integral part of learning mathematics (Nacico-Brown et al., 1994). The way in which students complete their assignment or homework is a measure of their attitude towards the subject. The assignment is valuable not only to the learner, but also the mathematics teacher as it helps to evaluate a learner's overall behaviour (MoEST, 2012).

Subjective tests include essay tests. They require the learner to read the question, think and organize ideas (Nacico-Brown et al., 1994). This type of test is used in measuring student's ability to organize, interpret, evaluate, and apply knowledge. Items such as "prove that" or "show that" in mathematics are examples of essay type of testing

Objective tests are written tests with items which require short answers. They fall into four main categories, namely: (i) multiple choice questions, (ii) true/false questions, (iii) Matching type questions, and (iv) completion type questions (Eggen & Kauchak, 2004; MoEST, 2012; Mwangi 2009). Multiple choice format is a measurement format that consists of a question or statement called a stem and a series of answer choices called distractors. The learner responds to the items by choosing the correct or best answer (Eggen & Kauchak, 2004). An example is: If $3x + 7 = 13$, then x equals: (a)10, (b)21, (c) 7, (d) 3.

True or false questions comprises a statement which is true or false (Eggen & Kauchak, 2014; Linn & Gronlund, 2000; Nacico-Brown et al., 1994). They usually measure lower- order outcomes (Linn & Grownland, 2000), and an example is: The square root of 4900 = 70 (T/F). Matching type questions comprise a statement called a stem followed by a set of items to the left-hand side and responses to the right-hand side, both listed vertically. Students are required the match the given items to the listed responses (Eggen & Kauchak, 2014; MoEST, 2012; Nacico-Brown et al., 1994. An example is: Match the figures (i.e., pentagon, triangle, trapezium) listed vertically on the left-hand side to their correct number of sides (i.e., 4,5,30 listed vertically on the right-hand side.

Completion type of questions consist of a statement with a missing word or number ((Eggen & Kauchak, 2014; MoEST, 2012; Nacico-Brown et al., 1994). Students are required to complete the statements by filling the missing word or number. For example; The square root of 81 is____. In mathematics, the subject teacher can also use projects to assess learners (MoEST, 2012). The teacher can give projects individually or in groups and they can be short or long term. There are projects which are carried out in the classroom, and these include: (i) making learning aids or (ii) investigating patterns and relationships. Out of classroom projects include: (i) collecting and analysing data, and (ii) collecting learning aids from the environment (MoEST, 2012).

Lastly, experts in measurement and evaluation recommend that teachers use four principles to design effective assignment practices. These are: (i) plan tests systematically using a table of specification (Campbell & Evans, 2000). The table demands that the teacher should assess learning objectives (i.e., knowledge, comprehension, application, analysis, synthesis, and evaluation) against the content areas in the

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test, (ii) the teacher should prepare students for assessments, for example, teaching test-taking strategies (Eggen & Kauchak, 2014). They include: (a) using test-time efficiently by pacing oneself, (b) reading instruction carefully, (c) identifying important information in questions, (d) understanding the demands of different testing formats, and (e) finding out how questions will be scored. To be effective, these strategies should be emphasized through the school years (Eggen & Kauchak, 2014). (iii) The teacher should administer tests and quizzes under optimal conditions to maximize students' performance. For example, keeping students informed about the amount of time remaining during a test, and (iv) the teacher should analyse test results and give immediate feedback. Research supports the benefits of individual feedback on tests. Students who receive positive comments or encouraging words on test outcomes do better on subsequent work (Page, 1992). Moreover, the effects of short personalized comments (e.g., good, can do better) justify extra efforts involved in future work in mathematics.

CONCLUSION

It is important for students to know how they doing as they learn. This is because knowledge of current understanding gives students a source of awareness of their achievement which may motivate them to learn more. Thus, it is absolutely essential for mathematics teachers to assess students' learning and give them immediate feedback (Anderson, 1993). Furthermore, assessment should be given to students as frequently as possible using oral tests, observation, written tests, and projects where possible and feedback given accordingly (Gore, 2000). Mathematics teachers should also be aware of the functions of assessment in the mathematics classroom as seen in this paper. These are; informing students of their attainment, diagnosing areas of strengths and weaknesses, guiding the student's future, informing the interested parties of student competence, providing feedback to instruction, providing an operational target to the learner, licensing candidates for a profession, and provision of equal educational opportunities. In all, effective assessments are congruent with goals and instructions, and effective teachers communicate what will be covered in assessments, allow students to practice on items similar to those that will be on tests, teach test-making skills, and give positive comments for student performance (Gore, 2000).

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